

PHYSIOLOGY

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**FEATURES OF HEART RATE AUTONOMIC REGULATION IN YOUNG BOYS
ENGAGED IN SOCCER AND ARTISTIC GYMNASTICS**

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Annotation. To assess effect of sports specificity on the formation of autonomic regulation in younger children, we conducted a study of heart rate variability among young gymnasts and soccer players aged 6-10. In the course of the study 80% of gymnasts and 64% of soccer players revealed a moderate predominance of the autonomous regulation mechanism (type III) with higher background activity of the parasympathetic division of the autonomic nervous system in soccer players. The activity of the autonomous circuit of regulation increases in soccer players with better sports experience, the intensity of sympathetic influences and the degree of tension of functioning of regulatory systems reduce, whereas the tonic activity of the sympathetic link of the autonomic nervous system and centralization of heart rate control increase in gymnasts.

Keywords: athletes, soccer players, autonomic regulation, autonomic reactivity, sports experience.

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**IMPACT OF LIVING ENVIRONMENT ON PHYSIOLOGICAL AND
PSYCHOLOGICAL SIGNS OF PSYCHOEMOTIONAL STRESS IN ADOLESCENTS
WITHOUT PARENTAL CARE**

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Annotation. Adolescents without parental care experience psychoemotional stress, which disturbs somatic and mental health, worsens their socialization. Catecholamines take the leading role in response to stress. This work includes a comparative study of sympathoadrenal regulation of emotional signs of stressful reactions in adolescents without parental care, who live in social establishments and foster families. The results obtained have revealed that adolescents from social establishments have a significantly higher level of anxiety and aggression, as well as high possibility of premature depletion of adaptive resources of the growing organism with the pronounced stress development. We have also found correlations of adrenaline in saliva and blood with anxiety and anxious estimation of future, noradrenaline in saliva and blood with aggressiveness, irritation and overall stress.

Keywords: adolescents without parental care, forms of foster care, foster families, psychoemotional stress, sympathoadrenal system, anxiety, aggression.

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THEORETICAL AND METHODOLOGICAL ASPECTS OF THE SPEED-STRENGTH FITNESS'S FACTOR STRUCTURE OF KARATEKAS OF DIFFERENT AGE

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Annotation. The article deals with the problem associated with the identification of the factor structure of developing speed-strength qualities in 10–18-year old karatekas. The objective of the study: to theoretically and methodologically substantiate the age features of the formation of the factor structure of speed-strength qualities in young karatekas. The study involved male karatekas with sports experience up to 3 years at the age of 10 to 12 years (18 people), 3-5 years at the age of 13 to 15 years (24 people) and more than 5 years at the age of 16 to 18 years (16 people). The following six factors influencing the development of speed-strength qualities in leg extension while kicking were identified using a force plate: absolute speed, maximum explosive force, muscle starting strength, muscle accelerating power, absolute muscle strength and total body size. We have found that with the increase in sports experience and age of the athletes there are significant changes in priority of certain factors by the value of their contribution to the generalized variance of the sample. Following age features of forming the factor structure of speed-strength qualities were identified: at the age of 10-12 years, the role of muscle starting strength and muscle accelerating power increase; at 13-15 years, values of absolute muscle strength and absolute speed increase; at 16-18 years, the role of maximum explosive force and absolute muscle strength increase.

Keywords: structure, factors, karatekas, age features, speed-strength qualities.

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FEATURES OF SPECIFIC PHYSICAL FITNESS OF ADOLESCENTS WHEN PERFORMING CLEAN AND JERK IN ISOKINETIC MODE

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Annotation. The study's objective – to substantiate efficiency of applying isokinetic mode in the performance of clean and jerk by young athletes with intense weights while using the athlete training device. The main idea of the device is to provide controlled, even and prompt assistance during the exercise, without affecting the individual features of the structure and speed of the barbell lift. For the pedagogical experiment, we formed a group of young 2 and 1 rank weightlifters aged 13-14 years (n=12). They performed clean and jerk with the training device in isokinetic mode according to the following scheme of combining load options: 1st option (training with the device) – 80% of the maximal load, 4-5 repeats in one approach, 4 approaches in one training; 2nd option (training with the device) – 90% of the load, 3-4 repeats in one approach; 3rd option (training with the device) – 100%, 2-3 repeats in one approach, 4 approaches for one training. 3 months after, the study's results have revealed a high level of effectiveness of the isokinetic method in performing clean and jerk with the 80 to 100% load in the training of young weightlifters.

Keywords: isokinetic mode, clean and jerk, load options, adolescents, athlete training device.

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MAST CELLS IN COMBINED TRAUMATIC BRAIN INJURY AND SYSTEMIC INFLAMMATION: EXPERIMENTAL STUDY

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Annotation. In case of traumatic brain injury (TBI), the interaction of the brain with the lungs affects the risk of developing an unfavorable course of the disease in patients. The purpose of this study: to analyze the state of mast cells (Mc) in various animal organs while modeling the TBI comorbidity and systemic inflammation. The data obtained demonstrate that against the background of a significant increase in the amount of Mc in the tissues of the peripheral part of the lungs, a high level of Mc degranulation was registered. In the anterior hypothalamus preparations and in the blood vessel walls, we have found a structured metachromatic material of basophilic leukocytes, which was represented by rounded red formations 2-4 μm in diameter.

Keywords: mast cells, traumatic brain injury, systemic inflammation, respiratory organs.

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REGULARITIES AND MECHANISMS OF NERVOUS AND HUMORAL REGULATION ON THE EXAMPLE OF ELECTROCARDIOGRAM PARAMETERS' REGISTRATION IN ANIMALS IN A STATE OF HYPOTHERMIA

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Annotation. The introduction of astronauts into a state of hypothermia during long space flights is one of the topical issues of space physiology. The aim of the work was to study the electrocardiography parameters in rats in a state of hypothermia. During the study, the heart rate and some electrocardiographic parameters were studied: the P wave, the QT interval, as well as the QRS complex when rats are exposed to cold. As a result, it was found that transitional hypothermia has a negative effect on the heart work, but the changes are reversible. The obtained data can be used for further space-related research on the effect of hypothermia on heart function in mammals, including humans.

Keywords: hypothermia, adaptation to cold, electrocardiogram, ECG parameters, rats.

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AGE-RELATED FEATURES OF BLOOD PARAMETERS, PHYSICAL ENDURANCE AND PSYCHOEMOTIONAL STATE OF STUDENTS DEPENDING ON THE LEVEL OF DAILY MOTOR ACTIVITY

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Annotation. Currently, the problem of physical inactivity remains relevant in universities among young students due to the active introduction of the distance learning format into the educational process. Restriction of physical activity is aggravated by systematic psychoemotional stress of students. The aim of the study was to examine the age characteristics and relationships of blood parameters, physical endurance and psychoemotional state of students, depending on the level of daily motor activity. The study found that systematic physical activity during the training period practically did not affect the dynamics of the studied indices, but contributed to the increase in physical endurance of girls. At the same time, in physically active girls, an increase in physical endurance was associated with the activation of the functional activity of red blood. As follows from the analysis of factor structures, if in girls, who lead a sedentary lifestyle, the manifestation of physical abilities practically does not depend on the psychological state and activity of red blood, then in case of regular exercising their formation is influenced by both the current psychoemotional state and the state of the blood respiratory function.

Keywords: psychoemotional stress, physical endurance, motor activity.

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CHANGES IN RHEOVASOGRAPHY INDICES OF MEN IN WOMEN IN AGE ASPECT

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Annotation. The article presents results of long-term studies on the peripheral blood flow of men and women aged 15-60 years, healthy and with signs of lower limb varicose veins. All rheovasography indices were divided into three main groups: indices of the arterial blood flow intensity; indices of tone and elasticity of vessels; venous blood flow indices. The analysis of examined indices allowed us to conclude that men and women with varicose veins have reduced tone of major arteries, accompanied with slowed blood flow and decreased elasticity of vessels. The most pronounced state was registered in men aged 51-60 years and women aged 41-60. When analyzing the state of the venous systems of the lower leg and foot, we found that men with varicose veins during all age periods have slower venous outflow from the lower leg compared to healthy men.

Keywords: peripheral circulation, arterial blood flow, venous blood flow, rheovasography, lower limb vessels, lower limb varicose vein disease.

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EFFECT OF MAXIMUM MUSCLE LOAD ON HEMOSTASIS IN RATS

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Annotation. The influence of maximum physical activity on morphofunctional properties of platelets, the coagulation ability and biochemical parameters of the blood plasma in rats was studied. It is shown that during muscle load there is an increase in the latent period, a decrease in speed, maximum amplitude, impaired aggregation reversibility, as well as an increase in prothrombin, thrombin time and a decrease in blood fibrinogen content against the background of an increase in the concentration of nitrite ions and a decrease in calcium content. The morphometric parameters of platelets increase, and the index of their rejuvenation decreases. The process of osmotic swelling of blood plates is disturbed. Dysfunction of hemostasis mechanisms can be associated with the depletion of reserves or the damaging effect of lactate and hydrogen ions.

Keywords: muscle load, hemostasis, platelets.

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AGE FEATURES OF THE REACTION TIME OF RHYTHMIC GYMNASTS AGED 4-14 YEARS

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Annotation. The study is devoted to age features of psychomotorics: time of simple and complex sensorimotor response of female rhythmic gymnastics. It included 122 athletes aged 4-14 years (beginners, 1-3 youth and 1-3 adult ranks). The work was carried out with the help of computer diagnostics on the “Sports orientation of children and adolescents” complex and in the testing of the new developed informational and analytical system – the “Psychofunctional state control in rhythmic gymnastics classes” complex. The results from the sensorimotor response’s age dynamic study revealed a significant reductions (improvement) of indices’ values at the age of 7 and 13 years. The data obtained correspond with literature references and partially match to critical age ontogenesis periods. The conducted study allowed us to develop criteria of psychomotor indices’ stage-based control in rhythmic gymnastics.

Keywords: rhythmic gymnastics, girl athletes, mental development, age features, reaction time, psychomotorics.

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GENDER AND AGE FEATURES OF THE STUDENTS’ PHYSICAL DEVELOPMENT PARAMETERS

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Annotation. The aim of the research: to assess parameters of physical development of modern students during the period of study in a university. We have revealed the correspondence of main physical development parameters of young men and women. According to anthropometric parameters young men and women from the Samara University don’t differ from young people who live in the other European regions of Russia. Meanwhile, body length, mass and body mass index of Samara students are lower than such parameters of peers from Chelyabinsk, but higher than parameters of students who live in the north or in the south of Russia. We have found the underweight in 25,41% of young women and 12% of young men; tendency to be overweight and obese is revealed among young men more often than among young women. As they get older, the amount of young women with underweight that leads to severe violation of health is getting lower and there is a tendency to the growth of amount of young women with optimal body weight. Greater number of young people have balanced body parameters at older age.

Keywords: students, physical development parameters, gender and age features.

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ANALYSIS OF THE DYNAMICS OF MORPHOPHYSIOLOGICAL PARAMETERS AND DIET COMPONENTS OF JUNIOR STUDENTS IN THE PROCESS OF ADAPTING IN THE UNIVERSITY

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Annotation. The objective was to analyze changes in the morphological parameters, physiological parameters and the actual diet of students who are in the process of adapting to studying at a university. A longitudinal study of the annual dynamics of indicators of physical development (body length and mass), body composition (muscle and fat components), biochemical parameters of blood (total cholesterol, high and low density lipoprotein cholesterol, triglycerides, glucose) and the diet’s structure (proteins, fats and carbohydrates content) was

carried out for the first and the second year students. It was discovered that the contribution to the increase in body mass of the examined girls was achieved by an increase in muscle tissue, in boys – by both muscle and fat components. An imbalance of macronutrients in the diet was revealed in the first year, as well as a relative stabilization in the second year of study. The dietary energy supply of boys had a negative trend due to a decrease in carbohydrate intake. The level of triglycerides and high-density lipoprotein cholesterol in the blood of students had a tendency to increase.

Keywords: adaptation, physical development, blood biochemical parameters, diet, students.

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LIFESTYLE FEATURES OF STUDENTS LIVING IN HIGH LATITUDE CONDITIONS

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Annotation. Student youth is an important part of a society, health of which is subjected daily to a combination of unfavorable factors leading to chronic pathologies that significantly worsen the level of mental and physical activity of students. The objective – to identify lifestyle features of students living in the northern region conditions. The study took place in the Surgut State University and included 200 1-6-year students aged 18-25 years, both genders, full-time. To analyze their lifestyle, we have developed a questionnaire including 27 questions that describe various life aspects of young people. More than a half of young people do not sleep and eat properly, spend a significant amount of time on a computer for doing home tasks and resting from working and studying. Time spend on a computer took 3 to 5 hours in average for 60% of young men and women, for 18% of students – 6 to 7 hours, 16% – 8 to 10 hours. A significant portion of young people (more than 80%), who live in the north, are overweight. Special attention must be given to issues related to long hours on a computer and lack of physical activity. There is also a need to consider problems related to sleep and nutrition. Moreover, young people do not consider different methods of improving body resistance.

Keywords: students, lifestyle, Middle Ob, health, physical activity, diet, sleep.

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STUDY OF HEART RATE VARIABILITY WITH BIOLOGICAL FEEDBACK IN YOUNG GYMNASTS IN CONDITIONS OF DEMONSTRATION PERFORMANCES

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Annotation. The article presents the results of assessing the heart rate variability (HRV) of 4-year-old gymnasts, reflecting the regulation features of the cardiovascular system function of young athletes during exhibitions. The activation of the sympathetic division of the nervous system was observed according to the values of the mode amplitude (AMo), stress index (SI), regulatory systems of heart rate (HR). In the spectral analysis of HRV, the share of the total low frequency activity was 71.4%, which indicates the centralization of the HR regulation mechanisms. The predominance of very low frequency activity (VLF) in the HR structure reflects the activation of humoral and metabolic processes, the state of energy deficiency in physical and psychoemotional fatigue. There was a direct high correlation between SI and the

psychophysiological cost ($r=0.99$). The presence of ultra low frequency waves (ULF) reflects the involvement of higher regulatory centers of HR associated with their ontogenetic immaturity. The results obtained will serve as a theoretical basis for the selection of means for restoring the expended resources of the body of young gymnasts after exhibitions.

Keywords: young gymnasts, heart rate, spectral analysis, cardiovascular system, functional state, heart rate regulation, fatigue.

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SEDENTARY LIFESTYLE AND ITS INFLUENCE ON THE ROBINSON INDEX IN MALE STUDENTS OF TYUMEN UNIVERSITIES DURING THE COVID-19 PANDEMIC

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Annotation. There is no need to say that the COVID-19 pandemic has significantly disrupted the socio-economic status and habitual life of every person on earth and required the introduction of stay-at-home restrictions for a relatively long time in our country. For students around the world, the COVID-19 pandemic has forced a change in the way they have been taught for centuries, moving to a distance form of education that uses the Internet while staying at home. The aim of our research was to study the effect of sedentary lifestyle caused by forced restrictions due to the COVID-19 pandemic on the chronobiological indicators of the Robinson index in first-year male students of specialized Tyumen universities.

Keywords: COVID-19 pandemic, self-isolation, young students, central hemodynamics, Robinson index.

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THE MOST INFORMATIVE METHOD FOR IDENTIFYING ANAEROBIC THRESHOLD BASED ON MEASURING HEART RHYTHM

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Annotation. The study provides an overview of three methods for identifying anaerobic threshold (AT) based on measuring heart rhythm: the Conconi test, determining AT from heart rate variability data and the graphical method. Based on the data of an experimental study on runners ($n=11$), these methods were compared in terms of the informative value of the results obtained with the reference lactate method for identifying AT (modified Dmax method). Comparison with the reference method was made in terms of running speed, heart rate and lactate concentration on AT. The most informative method for identifying AT from the three studied methods was chosen.

Keywords: anaerobic threshold, Conconi test, Dmax.

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AUTONOMIC REACTIVITY IN INDIVIDUALS WITH DIFFERENT TYPES OF INITIAL AUTONOMIC TONE UNDER MENTAL STRESS

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Annotation. The features of the body's reaction to performing the Bourdon test under stressful conditions, depending on the initial autonomic tone, were examined. The relationship of the initial autonomic tone with stress resistance and autonomic reactivity was demonstrated. In subjects with the vagotonic type of the initial autonomic tone, reactivity is higher than in those with the normotonic type. Identification of the initial autonomic tone, coupled with the use of the Bourdon test, may have a prognostic value of stress resistance.

Keywords: stress, stress resistance, mental performance, cognitive abilities, initial autonomic tone.

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INFLUENCE OF “SOCIAL” STRESS AND SCUTELLARIA BAICALENSIS GEORGI EXTRACT ON THE GLUCOSE LEVEL IN THE PLASMA OF NON-PEDIGREE RATS

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Annotation. The work is devoted to the study of the effect of “social” stress and *the Scutellaria baicalensis Georgi* extract on the plasma glucose level of animals. The study was carried out on 96 mature male non-pedigree rats weighing 295±12.17 g at the age of 7-9 months. “Social” stress modeling in groups was done by developing inter-male confrontations under conditions of paired sensory contact. The content of glucose in the biological material (blood plasma) was identified by the enzymatic (hexokinase) ultraviolet method (mmol/l). The presented data indicate that the reproduction of a pathological state in the form of “social” stress leads to a significant increase in glucose levels relative to the control group in the norm in species of both dominant and submissive types. A significant increase in the glucose content in the control group, subject to “social” stress among the victims, compared to the aggressors was found. Based on the obtained experimental data, it was revealed that the *Scutellaria baicalensis Georgi* extract has a corrective effect on glucose levels in anxiety and depressive disorders caused by “social” stress modeling.

Keywords: glucose, “social” stress, extract, *Scutellaria baicalensis Georgi*, biologically active substances, aggressors, victims.

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COMPREHENSIVE ASSESSMENT OF HEALTH STATUS OF EARLY ADULT MEN WITH DIFFERENT MOTOR ACTIVITY LEVELS

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Annotation. Objective: to identify individual and typological features of the motor activity, anthropometric and lipidic indices in early adult men. The study included 285 participants (29.7±3.54 years). We applied a set of methods: identifying motor activity during the day with pedometry, health status assessment (medical history gathering, anthropometry), bioelectrical impedance analysis (Inbody 770, Korea), identifying lipidic indices (LOGIQS8 ultrasound diagnosis device, USA), statistical data processing. As a result, we have revealed the individual

and typological features of anthropometric, lipidic, bioelectrical impedance indices of early adult men with various levels of motor activity. The group of men with the body mass index of 25.0-29.9 kg/m² were categorized as being at risk for developing obesity. For this group of men it is necessary to develop an individual program of motor activity and nutritional correction. The reason for this is the fact that physiological mechanisms of functioning of organs and systems of the male organism are closely interrelated with the motor sphere.

Keywords: health status comprehensive assessment, functional constitution types, early adult men.

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EVALUATION OF REGULATORY SYSTEMS' ACTIVITY AND HORMONAL PROFILE OF WOMEN OF REPRODUCTIVE AGE ENGAGED IN FITNESS

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Annotation. The purpose of this study was to evaluate the indices of activity of the regulatory systems (IARS) and hormonal profile in women of reproductive age regularly engaged in fitness (3 times a week for 60 minutes) for at least three months. The study involved 84 women, all of them were divided into two groups: test group – women involved in fitness; control group – women with daily physical activity, not engaged in fitness. The calculation of IARS was carried out according to five criteria: the total effect of regulation, automaticity of the heart, autonomic homeostasis, stability of regulation, and activity of subcortical nerve centers. The concentration of hormones (luteinizing hormone, follicle stimulating hormone, estradiol, progesterone) was identified by enzyme-linked immunosorbent assay. It has been established that regular fitness sessions have a positive effect not only on IARS, the hormonal reproductive profile due to the harmonization of the menstrual phases, but also on the body mass index, thereby increasing the adaptive potential of the body, and, as a result, protecting the body from most pathological diseases and states.

Keywords: indices of activity of the regulatory systems, fitness, hormones.

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REGULATORY AND ADAPTIVE POTENTIAL OF ELITE ATHLETES TRAINING ON A DOUBLE MINI TRAMPOLINE

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Annotation. An analysis of the field-specific literature of domestic and foreign experts indicates that the elite sport is an object of significant interest in pedagogical and clinical research. The cardiorespiratory system and the musculoskeletal system is one of the most vulnerable vital systems of the body during maximum physical activity, especially during the competitive period. One of the urgent problems for elite athletes in complex coordination sports is to determine the functional reserves of the cardiovascular and respiratory systems, which reduce the risk of developing pathological reactions on the one hand and optimize physical activity in the structure of training sessions.

Keywords: complex coordination sport, elite athletes, functional reserves, cardiovascular system, competitive period.

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FEATURES OF ADAPTATION TO STRESS IN WATER SPORTS ATHLETES

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Annotation. The article presents the results of studying the specifics of the psychophysiological response of elite water sports athletes to a stressful situation and assessing their adaptive capabilities through the indices of recovery rate after stress. The study involved athletes of the national teams of the region engaged in synchronized swimming and rowing. Psychophysiological testing was organized with the stressful situation modeling. Tests of sensorimotor reactions with instrumental stimulus presentation were used as stressors, heart rate variability was evaluated. Subjective assessment of the athletes' condition was estimated with the WAM ("well-being, activity, mood") questionnaire. As a result, the specific features of the response to stress of rowers and synchronized swimmers have been identified, the data obtained can be used to compile programs for psychological correction of water sports athletes, depending on their specifics.

Keywords: stress response, adaptation, heart rate variability, stress index.

BALNEOLOGY AND REHABILITATION

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PSYCHOPHYSIOLOGICAL STATE DYNAMICS OF ASTRONAUTS DURING POST-FLIGHT MEDICAL REHABILITATION AT THE SANATORIUM-RESORT STAGE

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Annotation. The aim of the work was to identify the psychophysiological state dynamics of astronauts during the period of post-flight medical rehabilitation at the sanatorium-resort stage. 5 astronauts took part in the study. The program of the 2nd stage of the post-flight medical rehabilitation of astronauts in sanatorium-resort conditions included both cutting-edge treatment methods and treatment with natural resources: robot-assisted mechanotherapy of the musculoskeletal system, neurofeedback according to the β -rhythm of the brain, barotherapy, carbon dioxide-sulphur baths, salt therapy, inhalation therapy, drinking the “Slavyanovskaya” mineral water, mud therapy, hydromassage, massage, free swimming, magnet therapy. The results of the diagnostic study before and after the rehabilitation course revealed positive dynamics in the total functional state of the astronauts' body: the index of regulatory processes' tension decreased, indices of central hemodynamics, blood oxygen saturation and mental performance improved.

Keywords: astronauts, rehabilitation, recovery, sanatorium-resort treatment, mechanotherapy, psychophysiology.

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DEVELOPMENT AND SCIENTIFIC JUSTIFICATION OF THE THERAPEUTIC AND RECREATIONAL, LANDSCAPE AND CLIMATIC POTENTIAL OF THE “TROPA ELANKA” TERRAIN CURE PATH IN YUZHNO-SAKHALINSK

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Annotation. The objectives of the research were to develop and scientifically substantiate the therapeutic and recreational, landscape and climatic potential of the “Tropa Elanka” terrain cure path in Yuzhno-Sakhalinsk. The research materials included the results of comprehensive monitoring (bioclimatic, landscape, ecological) of the “Tropa Elanka” terrain cure path, reference materials of long-term (meteorological, heliophysical, ecological) observations on the weather station of Yuzhno-Sakhalinsk and guiding documents. The research has shown that the landscape and recreational potential of the “Tropa Elanka” terrain cure path located in the “Gornyj Vozdukh” Sports and Tourism Complex according to the modular technology accepted in balneology reaches 2.38 points out of 3 possible, which corresponds to Rank 1 and is evaluated as favorable. Integral index of microbioclimatic potential K(BKP) is 2.24 points out of 3.0 possible, which conditionally corresponds to the gentle effect of microbioclimate on the human body and favorable conditions for health tourism, as well as the increased potential of the area under consideration for climate therapy.

Keywords: landscape and climatic potential, terrain cure, ecology, bioclimate, health tourism, recreation, Sakhalin.

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**ANALYSIS OF THE RECREATIONAL POTENTIAL OF FOREST PLANTATIONS AND
EVALUATION OF THE THERAPEUTIC AND PREVENTIVE PROPERTIES OF
INDIVIDUAL COMPONENTS OF NATURAL PHYTOAEROTHERAPY**

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Annotation. The literature analytical review is devoted to the issues of a systematic assessment of the recreational potential of forest plantations for the scientific justification of the expansion of health services in the structure of rehabilitation and prevention of various diseases and the possibility of using natural phytoaerionization in the sanatorium-resort complex. Special attention is paid to the role of forest plantations and other environmental factors in the formation and stability of negative air ions in the surface layer of the atmosphere, as well as to the analysis of the influence of forest walks on the nonspecific resistance to stress loads.

Keywords: forest plantations, natural therapeutic resort factors, aeroionization, prevention, rehabilitation.

SPORTS MEDICINE

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THE EFFECT OF MASSAGE ON ATHLETES' SPORTS AND CLINICAL OUTCOMES: LIVING UMBRELLA REVIEW OF SYSTEMATIC REVIEWS AND META-ANALYSES

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Annotation. Massage is a tool that is frequently used in sports and physical activity (fitness) in general for recovery and performance enhancement. The aim of this study was to conduct an updated systematic search and synthesis of systematic reviews and meta-analyses on the effects of massage on physiological and clinical performance of athletes. The study methodology was a systematic search of publications dated between February 2003 and July 2023 in PubMed, Cochrane Library, Epistemonikos, MedNar, and the Russian databases – eLibrary and Russian State Library. The methodological quality of the included articles was assessed with the Assessment of Methodological Quality of Systematic Reviews tool (AMSTAR-2). Study outcome: the overall methodological quality of the six included reviews obtained using AMSTAR-2 revealed a very low confidence rating (extremely low confidence, n=6) for the results of systematic reviews and meta-analyses. Conclusions: no significant effect of massage on physiological and clinical parameters of athletes was found. However, a positive effect of massage on the psychoemotional state of the athlete was noted.

Keywords: massage, sports massage, sports, performance, systematic review, meta-analysis, living review.

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ASSESSMENT OF PHYSICAL WORKING CAPACITY OF ATHLETES WHEN CARRYING OUT A SPECIFIC LOAD TEST DURING AN IN-DEPTH MEDICAL EXAMINATION

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Annotation. One of the urgent tasks of sports medicine is the development of unified protocols and an increase in the efficiency of evaluating results while expanding the in-depth medical examination of athletes (IME), staged comprehensive examination (SCE) and extensive medical supervision (EMS). The purpose of the study is to substantiate the conduct of specific tests in professional athletes at the IME stage. A comparative assessment of the current and dynamic functional state of athletes of the Russian national team was carried out during the IME according to the scale of standard and specific load tests. The results of load test with the use of various ergometers allow us to state the reception of close to the “true” values of the physical working capacity indices of athletes. The proposed approach makes it possible to increase the prognostic significance of the method, as well as to identify early signs of overtraining in athletes during IME.

Keywords: in-depth medical examination, specific load test, athletes, physical working capacity, maximum oxygen consumption.

THEORY AND METHODS OF SPORTS

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DESCRIPTION OF SPECIFIC PHYSICAL WORKING CAPACITY AND PSYCHOMOTOR QUALITIES OF SOCCER PLAYERS OF MASS CATEGORIES (SECOND LEAGUE)

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Annotation. In the conducted study, a complex description of specific physical working capacity and psychomotor qualities of a group of 10 soccer players of mass categories playing in the second league team of the Russian Championship is given. The studied soccer players had low rates of aerobic capacity, and, consequently, a low level of specific functional fitness. Psychomotor qualities were characterized by average levels of dexterity and time of sensorimotor reactions, satisfactory mental performance, good mental work-up and stability. As studies have shown, the most significant factor limiting the performance of mass category soccer players is the insufficient level of aerobic capacity. Other disadvantages of their fitness, which should be improved, are the insufficient level of agility, speed and mental capacity.

Keywords: soccer, performance, psychomotorics, reaction time, ergospirometry, aerobic capacity.

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FEATURES OF IMPROVING PHYSICAL DEVELOPMENT INDICES OF KICKBOXERS AND BOXERS AT THE AGE OF 8-13 YEARS

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Annotation. The article presents the results of the physical development of kickboxers aged 8-13 years, their physiological substantiation, group comparison in the age cohort and in the sports improvement dynamics. Kickboxers aged 10-13 years have higher indices of speed-strength and strength endurance, flexibility and explosive strength of leg muscles compared to children who do not engage in sports. At the age of 10-11 years, kickboxers are inferior in dexterity to boxers, but by the age of 12-13, the figure levels off. From 10-11 to 12-13 years old, kickboxers have a clear jump in flexibility, in comparison with other groups, which indicates a more elastic ligament system. At the age of 10-11 and 12-13 years, the level of development of strength endurance of the extensor muscles of the arms of kickboxers is significantly lower than that of boxers, and higher than that of children who do not engage in sports, which is explained by an even distribution of the load on the upper and lower limbs in the training process.

Keywords: kickboxers, boxers, sports improvement, physical qualities.

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DEVELOPMENT OF PHYSICAL QUALITIES OF YOUNG ATHLETES FROM CHELYABINSK AGED 7-10 YEARS

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Annotation. This study presents the assessment results of the development of physical qualities of young athletes from Chelyabinsk aged 7-10 years (boys and girls, 40 people in each age and gender group). It is revealed that for boys, a favorable period for the development of speed-strength and coordination abilities is the age of 8-9 years, 9-10 years – for the development of the endurance quality, the flexibility quality – from the age of 9; in girls, the greatest improvement in the speed quality was noted at the age of 7-10 years, the age of 7-8 years is a favorable period for the development of coordination, 7-10 years – speed-strength and strength abilities. For both boys and girls, 9-10 years is a favorable age for the development of leg muscle strength

Keywords: physical qualities, sensitive period, children, athletes, primary school age.

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UDC 796.01; 612

THE IMPACT OF CHANGES IN INTERNATIONAL RULES IN GRECO-ROMAN WRESTLING ON THE TECHNICAL AND TACTICAL COMPONENT OF A MATCH AND PHYSICAL FITNESS OF WRESTLERS

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Annotation. The article provides a brief overview of the changes in international competition rules in Greco-Roman wrestling over the past 20 years. It also provides data on the impact of changes on the technical and tactical pattern of matches and the process of physical training. The results of the work demonstrate that the visual appeal of matches in Greco-Roman wrestling is directly related to changes in the international rules of competitions. The global changes that took place in the rules of 2013 had a positive effect on the visual appeal and increased the intensity. The rules' variability of the competition affects the specific and total physical fitness, as it is necessary to adapt to the new requirements put forward for the athletes taking part in the competition.

Keywords: Greco-Roman wrestling, physical training, technical and tactical training, development of physical qualities, changing the competition rules.

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UDC 613.71; 376.433

EXPERIMENTAL VALIDATION OF PHYSICAL CULTURE METHODS FOR THE DEVELOPMENT OF COORDINATION ABILITIES OF STUDENTS WITH INTELLECTUAL DISABILITIES

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Annotation. The article presents the results of the implementation of the physical culture methods for the development of coordination abilities of primary school students with intellectual disabilities. The necessity of applying interdisciplinary relationships in the development of coordination abilities of the examined group is validated, and the forms of work aimed at improving the pedagogical process under consideration are highlighted. The application of the developed methods allowed to increase the indices of coordination abilities of primary school

students with intellectual disabilities, which reflects its effectiveness and confirms the expediency of using it in the educational process.

Keywords: students with intellectual disabilities, coordination abilities, adaptive physical culture, interdisciplinary relationships, educational process, socialization.

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KEY DIRECTIONS OF TECHNICAL AND TACTICAL TRAINING OF HOCKEY PLAYERS OF DIFFERENT QUALIFICATION

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Annotation. The purpose of the study is to present the structure of the in-game situation in a set of individual conditions, circumstances, as an intellectual “product” of the subject, significantly affecting the tactical and technical training’s content. We examined different approaches to tactical and technical training of team sports athletes. It is noted that when planning such training it is necessary to take into account the following conditions: to know the tasks and goals of competitive activity; to study the weakest and strongest sides of the opponent's physical, psychological, technical, tactical and integral fitness; to take into account all the conditions of the upcoming game; to mentally make a estimation of difficulties and obstacles that may have to meet; to think about what measures and techniques will be necessary to achieve success; to make several plans of tactical actions, taking into account possible changes of the rivalry.

Keywords: tactics, technique, situation, hockey, game tasks.

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MODEL OF VISUAL ANALYSIS OF TECHNICAL AND TACTICAL ACTIVITY OF TEAM SPORTS ATHLETES

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Annotation. Objective of the study: to identify the features of visual analysis of sports activity in team sports using augmented reality tools. We defined the information technologies often used by team sports coaches during the training process and competitive activity. The processing sequence of the image obtained as a result of the competitive activity video recording is presented. Visual analysis in team sports allows to improve tactical and technical actions of athletes and teams on the basis of developing situational exercises, creating graphic in-game schemes, as well as forming a database of in-game situations and exercises.

Keywords: tactics, technique, analytics, visual simulation, modeling, game.

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INFLUENCE OF GENDER DIFFERENCES AND SPORTS SPECIALIZATION ON THE LEVEL OF SPATIAL AND HAND AGILITY DEVELOPMENT

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Annotation. The article discusses the methodological problems and conditions of spatial and hand agility testing. We have discovered the results of identifying spatial agility, the criterion of which is the length ratio of backward and forward standing long jumps. The research on hand agility was carried out according to the results of the “Test of American pilots” computer game. The study was conducted at the Faculty of Physical Culture of the State University of Education during 2022-2023 and included 21 girls and 28 young men aged 17-18 years of various sports specialization studying in the “Sports Training” education profile. As a result, we have found statistically significant gender differences in the relative index of spatial agility in boys and girls. For young men, this figure is 15% higher. As a result of one-factor ANOVA, the validity of the following hypothesis was established: “there is an influence of gender on the test results”. Also, we have identified statistically significant differences in the spatial agility values among single combat athletes from others and representatives of cyclic sports from others. The validity of the other hypothesis was confirmed as well: “there is an influence of the sport on agility”. When studying the hand agility of young men, a trend of increasing results was revealed, characterizing their better learning ability compared to girls. In terms of initial agility, single combat athletes and representatives of aesthetic sports demonstrated the best results, while representatives of game and esthetic sports had the best indices in terms of learning ability.

Keywords: sports, coordination, sensorimotor tests, movement building levels, physical qualities.

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UDC 796

CORRELATION BETWEEN PERFORMANCE AND MORPHOLOGICAL MODEL PARAMETERS IN ELITE ATHLETES (LITERATURE REVIEW)

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Annotation. An analysis of the literature has shown that at present there is a lack of information on changes in individual parameters of morphological models of elite athletes, leading to worse performance in sports and/or individual disciplines. The connection of the morphofunctional parameters of athletes of various sports, different disciplines, stages of training, age and gender will allow coaches to more accurately choose training methods for athletes with different morphofunctional parameters and manage the training process as part of long-term training.

Keywords: athletes, adaptation, sports discipline, effectiveness, morphological model, sports morphology, biomechanics, anthropometry, somatotype.

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GROUP AND INDIVIDUAL FEATURES OF HEART RATE VARIABILITY IN QUALIFIED SWIMMERS

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Annotation. Qualified young swimmers took part in the study. The aim of the research was to study the heart rate variability features in elite young swimmers with an emphasis on a personalized approach at the stages of a one-year training cycle. Athletes with high functional fitness have a standard reaction to orthostasis at the stages of the annual cycle. During the inter-competitive period, we have discovered a complete recovery with elements of hyperadaptation to

exercise. During an orthostatic test, swimmers with fatigue had a paradoxical reaction to orthostasis. In the period between competitions, there was no complete recovery of the body.

Keywords: athletes, stages of the annual training cycle, orthostasis, heart rate variability, individual approach.

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TECHNOLOGIES OF SPORT SELECTION AND ORIENTATION OF CHILDREN TO SWIMMING IN DIFFERENT STYLES

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Annotation. In order to identify promising ways and directions of solving the problem of choosing a sport specialization in sport swimming, we have carried out an analytical review of modern technologies of sport selection and orientation in swimming. The results of domestic and foreign researches in the field of knowledge about applied physiometric and morphometric indices of swimmers and their influence on future specialization in swimming are presented. We have found that at the stage of sports selection and orientation a wide range of indices characterizing the physical development of a young swimmer, as well as features of the bioenergetic systems' function are used. As a rule, the viability of an athlete is evaluated in relation to the sprinter or stayer specialization of the swimmer. Studies on the justification of sports orientation technologies to the chosen type of sports swimming are rather fragmentary. Our own preliminary research has shown that morphometric physique indices may become objective criteria of an athlete's viability in relation to the type of sport swimming: index of relative arm length, index of relative leg length and Skelia index, index of relative shoulder width, body mass index, APE index, Pinier index, Erismann index.

Keywords: young swimmers, sports selection, orientation.

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MOTIVATION AS A FACTOR IN CHOOSING A ROLE BY FLOORBALL ATHLETES

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Annotation. Motivation is the leading element of the personality structure, being an innate part of an athlete's life and having effect on their direction of actions, personality traits, abilities, emotions, mental processes. It reveals to us the essence and content of its activity, makes a connection with the activity to be performed. It is not only one of the main characteristics of the players' personality, but also influences the nature of all the processes of sports activity (reaction to stress, recovery, learning new things, and much more). Floorball, with its intense training work and mentally difficult performance at competitions, is the very environment of human activity where motivation manifests itself very vividly, and the result of the player primarily depends on it.

Keywords: effectiveness, problem, role, motivation.

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INTERRELATION OF MORPHOFUNCTIONAL STATE FACTORS WITH THE LEVEL OF PHYSICAL WORKING CAPACITY IN SWIMMERS OF DIFFERENT QUALIFICATION

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Annotation. The level of general physical working capacity of swimmers who are at different stages of long-term sports training has been identified and the dynamics of the inclusion of various functional factors in its provision has been studied. It has been discovered that the physical working capacity of swimmers naturally increases with the improvement of their qualification, which is provided by the comprehensive development of all components of functional fitness and qualitative characteristics of the body's functional potential. At the same time, the role of various factors in providing physical performance changes dramatically in accordance with the stage of long-term sports training. At the initial stage of training athletes in providing physical performance, the factors of "morphofunctional power" play the leading role, at the intermediate stage, the factors of "functional mobilization" acquire the main importance, while at the final stage of adaptation to physical activity, the factors of "efficiency" already dominate while maintaining a high level of significance of the "functional mobilization" factors.

Keywords: swimmers, physical working capacity, functional factors, stages of preparation, sports training.

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ACROBATIC ELEMENTS OF SYNCHRONIZED SWIMMING

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Annotation. The relevance of the work is due to the currently observed trend of increasing the complexity and originality of competitive synchronized swimming programs through the mandatory inclusion of a certain number of acrobatic elements. The purpose of the study: to determine the qualitative originality of acrobatic elements of synchronized swimming. The paper considers the history of the development of acrobatics as theatrical performances, as a type of physical exercise and as a sport. The understanding of the acrobatic element, the qualitative originality of the dynamic elements of acrobatics, which are included in the program of synchronized swimming competitions, are revealed, the factors determining the speed and quality of mastering these elements are also identified.

Keywords: acrobatics, synchronized swimming, acrobatic elements, competitive programs, competition rules.

HEALTH AND ADAPTIVE PHYSICAL CULTURE

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ORGANIZATIONAL AND PEDAGOGICAL ASPECTS OF THE COORDINATING ABILITIES' DEVELOPMENT OF STUDENTS WITH INTELLECTUAL DISABILITIES

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Annotation. The article presents the results of a study aimed at developing organizational and pedagogical aspects of developing the coordination abilities of students with intellectual disabilities. An approach based on taking into account the mental, physical and socio-pedagogical features of such students is proposed, which provides an opportunity to correlate the aspects of the educational process and solve issues of effective management of the development process in the best way possible, while considering social adaptation as a target setting.

Keywords: intellectual disabilities, children, health limitations, coordination abilities, educational process, inclusive education, special educational needs, social adaptation.

BIOMECHANICS AND BIOENGINEERING

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LIGAMENT SYSTEM OF THE TOOTH, DIFFERENTIAL YOUNG'S MODULUS AND HYPERELASTIC MOONEY-RIVLIN MODELS OF THE PERIODONTAL LIGAMENT

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Annotation. The prediction of tooth mobility under functional dental loads requires a deep understanding of the mechanical behavior of the periodontal ligament (PDL), which is a critical issue in dental biomechanics. The possibility of replacing periodontium with artificial analogues possessing desired properties also requires knowledge of the periodontal ligament's mechanical properties. In this paper, the values of the coefficients of the Mooney-Rivlin models' family with a different number of parameters for the PDL hyperelastic material are obtained. The introduction discusses the relevance, state of the issue and theoretical background. Literature data and own calculations were used. We used the computer algebra system Mathcad 15.0 and the multipurpose software package ANSYS 2022 R2. Comparison of the results revealed the presence of significant discrepancies in the numerical values of these calculations. However, all Mooney-Rivlin models, starting with the three-parameter one, demonstrated good correlation with experimental data and minimal absolute and relative errors. The smallest standard deviation of the calculated data from the experimental data and the highest correlation with the calculated data was demonstrated by the nine-parameter model. The results obtained may contribute to the development of an accurate constitutive model of human PDL and the development of an artificial periodontal ligament.

Keywords: periodontal ligament, elastic moduli, hyperelasticity.

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REGIONAL BIOMECHANICAL VARIABILITY AND HYPERELASTICITY OF GINGIVAL TISSUES

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Annotation. We studied deformation, strength and hyperelastic properties of gingival tissues. The following sections of the gingivae were considered as objects of study: BAG – buccal attached gingiva, BAM – buccal alveolar mucosa, BM – buccal mucosa, LAG – lingual attached gingiva, LAM – lingual alveolar mucosa. We also applied literature data obtained on samples from young (6-9 months) pigs. It has been established that the deformation and strength properties of gingival tissues correlate with their structure at the micro level and the ratio of collagen and elastin fibers to the following coefficients: $R^{\sigma}=89.59\%$, $R^{K_{tc}}=89.86\%$, $R^E=90.75\%$, $R^{\epsilon}=-62.24\%$ и $R^{\epsilon_{crit}/\epsilon_{max}}=-35.22\%$. Linear, bilinear, exponential and hyperelastic models were analyzed: neo-Hookean, Mooney-Rivlin, Ogden, polynomial and Veronda-Westmann. Calculations were performed using the Mathcad 15.0 computer algebra system and the ANSYS 2022 R2 multipurpose software package. The accuracy of the simulation was evaluated. The neo-Hookean model is poorly suited to describe the mechanical properties of gingival tissues and mucosa. Due to the morphological and histological similarities between the soft tissues of the porcine oral cavity and the human oral cavity, this study characterizes the biomechanical behavior of porcine tissues in vitro as a representative model system. The information obtained can be useful in solving problems of soft tissue plastic surgeries.

Keywords: gingivae, mucous membrane, elasticity, strength, hyperelasticity.